

Supplemental Digital Content

Biomonitoring in California firefighters: metals and perfluorochemicals

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Table S1-1 Unadjusted β coefficients (95% CI) indicating change in firefighter (ln) PFDeA, PFHpA and PFHxS concentrations.

Independent Variable (n)	n	PFDeA β (95% CI)	PFHpA β (95% CI)	PFHxS β (95% CI)
Age (101)				
≥50	27	-0.138 (-0.680, 0.403)	0.070 (-0.600, 0.740)	0.138 (-0.334, 0.610)
40-49	36	0.116 (-0.408, 0.641)	0.433 (-0.215, 1.082)	0.169 (-0.288, 0.626)
30-39	29	0.030 (-0.507, 0.567)	0.268 (-0.397, 0.932)	0.065 (-0.403, 0.533)
20-29	9	0	0	0
Race (100)				
Hispanic	15	-0.271 (-0.663, 0.121)	-0.254 (-0.750, 0.243)	0.124 (-0.221, 0.469)
Other	7	0.387 (-0.162, 0.935)	-0.114 (-0.809, 0.581)	-0.143 (-0.626, 0.340)
White	78	0	0	0
Job title (101)				
Captain or Chief	36	-0.097 (-0.413, 0.218)	0.123 (-0.269, 0.516)	0.085 (-0.188, 0.359)
Engineer	20	-0.127 (-0.506, 0.252)	-0.070 (-0.542, 0.402)	0.062 (-0.266, 0.391)
Firefighter	45	0	0	0
Years as firefighter (100)				
>30	10	-0.377 (-0.894, 0.141)	-0.252 (-0.908, 0.404)	0.377 (-0.074, 0.827)
21 - 30	39	0.003 (-0.346, 0.353)	0.038 (-0.405, 0.482)	0.126 (-0.179, 0.431)
11 - 20	24	0.090 (-0.302, 0.482)	0.045 (-0.452, 0.542)	0.149 (-0.193, 0.490)
<11	27	0	0	0
Body fat percentage (101)				
>24	33	-0.130 (-0.470, 0.21)	-0.169 (-0.592, 0.254)	-0.264 (-0.553, 0.025)
>17.5 - 24	32	-0.077 (-0.419, 0.266)	-0.134 (-0.56, 0.293)	0.006 (-0.285, 0.297)
≤17.5	36	0	0	0
Body mass index (101)				
≥30	26	-0.595** (-1.008, -0.182)	-0.261 (-0.775, 0.252)	-0.229 (-0.602, 0.143)
25 - 29	57	-0.547** (-0.911, -0.184)	-0.676** (-1.129, -0.223)	-0.125 (-0.454, 0.204)
<25	18	0	0	0
House fire responses in last year (100)				
≥1/month	32	-0.229 (-1.259, 0.801)	-0.709 (-1.976, 0.557)	-0.395 (-1.289, 0.499)
<1/month	66	-0.211 (-1.226, 0.804)	-0.938 (-2.185, 0.309)	-0.382 (-1.262, 0.498)
none	2	0	0	0
Brush fire responses in last year (98)				
≥1/month	11	-0.130 (-0.700, 0.44)	-0.421 (-1.130, 0.287)	-0.057 (-0.556, 0.441)
<1/month	73	0.137 (-0.276, 0.55)	-0.276 (-0.789, 0.237)	-0.001 (-0.362, 0.360)
none	14	0	0	0
Vehicle fire responses in last year (100)				
≥1/month	34	-0.278 (-0.860, 0.304)	-0.104 (-0.837, 0.629)	0.066 (-0.440, 0.572)
<1/month	59	-0.092 (-0.653, 0.468)	-0.031 (-0.737, 0.675)	0.221 (-0.266, 0.709)
none	7	0	0	0
Commercial fire responses in last year (98)				
≥1/month	10	0.351 (-0.151, 0.853)	0.438 (-0.198, 1.075)	0.031 (-0.419, 0.481)
<1/month	58	0.159 (-0.150, 0.468)	0.123 (-0.269, 0.515)	0.146 (-0.131, 0.424)
none	30	0	0	0

Abbreviations: ln, lognormal; CI, confidence interval; SCBA, self-contained breathing apparatus; PPE, personal protective equipment. * $p < 0.05$, ** $p < 0.01$

27 **Table S1-1 (cont.).** Unadjusted β coefficients (95% CI) indicating change in firefighter (ln) PFDeA,
 28 PFHpA and PFHxS concentrations.

Independent Variable (n)	n	PFDeA β (95% CI)	PFHpA β (95% CI)	PFHxS β (95% CI)
Industrial fire responses in last year (100)				
≥1/month	8	0.261 (-0.274, 0.797)	0.057 (-0.617, 0.730)	0.057 (-0.406, 0.519)
<1/month	41	-0.085 (-0.38, 0.210)	0.036 (-0.336, 0.407)	0.161 (-0.094, 0.416)
none	51	0	0	0
Hazardous materials responses in last year (101)				
≥1/month	13	0.175 (-0.272, 0.621)	0.239 (-0.332, 0.810)	0.137 (-0.256, 0.530)
<1/month	54	0.379* (0.079, 0.679)	0.201 (-0.182, 0.584)	0.238 (-0.025, 0.502)
none	34	0	0	0
Firefighting foam used in last year (100)				
Type A only	64	0.427* (0.011, 0.843)	0.451 (-0.068, 0.97)	0.116 (-0.258, 0.490)
Type B only	3	0.388 (-0.488, 1.264)	0.157 (-0.935, 1.249)	0.307 (-0.481, 1.095)
Both A and B	20	0.039 (-0.448, 0.527)	-0.135 (-0.743, 0.472)	0.162 (-0.277, 0.600)
Neither	13	0	0	0
SCBA use with firefighting foam (87)				
No SCBA	67	-0.281 (-0.641, 0.079)	-0.188 (-0.650, 0.275)	-0.027 (-0.326, 0.272)
Uses SCBA	20	0	0	0
Wears SCBA during exterior fire suppression duties (97)				
Never	6	-0.288 (-0.927, 0.351)	-0.246 (-1.064, 0.571)	-0.530 (-1.085, 0.025)
Sometimes	68	-0.093 (-0.429, 0.243)	0.059 (-0.371, 0.489)	-0.260 (-0.552, 0.032)
Always	23	0	0	0
Wears SCBA during ventilation activities (96)				
Sometimes	30	0.150 (-0.152, 0.451)	0.193 (-0.197, 0.584)	-0.247 (-0.504, 0.009)
Always	66	0	0	0
Wears SCBA during overhaul (97)				
Sometimes	72	0.053 (-0.270, 0.376)	0.125 (-0.287, 0.537)	-0.126 (-0.412, 0.159)
Always	25	0	0	0
SCBA early removal during overhaul (97)				
Might remove	35	0.135 (-0.158, 0.428)	-0.03 (-0.406, 0.346)	-0.291* (-0.546, -0.037)
Never removes	62	0	0	0
PPE professionally decontaminated (100)				
≥12 months ago	54	-0.095 (-0.376, 0.187)	0.052 (-0.301, 0.405)	0.078 (-0.167, 0.323)
<12 months ago	46	0	0	0
Handwashing frequency per 12-hour shift (100)				
<8	31	0.095 (-0.346, 0.536)	0.026 (-0.533, 0.585)	-0.200 (-0.584, 0.185)
9 - 11	33	-0.104 (-0.541, 0.332)	-0.101 (-0.654, 0.452)	0 (-0.381, 0.381)
12 - 19	21	0.189 (-0.285, 0.663)	0.012 (-0.589, 0.612)	-0.087 (-0.500, 0.326)
≥20	15	0	0	0
Fire station construction year (100)				
before 1980	56	0.039 (-0.361, 0.439)	0.352 (-0.138, 0.842)	-0.219 (-0.563, 0.125)
1980 - 1999	28	0.108 (-0.335, 0.55)	0.477 (-0.065, 1.019)	-0.295 (-0.676, 0.085)
2000 or later	16	0	0	0

29 Abbreviations: ln, lognormal; CI, confidence interval; SCBA, self-contained breathing apparatus; PPE,
 30 personal protective equipment. * $p < 0.05$, ** $p < 0.01$

Table S1-2 Unadjusted β coefficients (95% CI) indicating change in firefighter (ln) PFNA, PFOA and PFOS concentrations.

Independent Variable (n)	n	PFNA β (95% CI)	PFOA β (95% CI)	PFOS β (95% CI)
Age (101)				
≥50	27	-0.066 (-0.398, 0.266)	-0.248 (-0.669, 0.173)	0.072 (-0.309, 0.452)
40-49	36	-0.054 (-0.376, 0.268)	-0.216 (-0.623, 0.192)	0.046 (-0.322, 0.415)
30-39	29	-0.167 (-0.497, 0.162)	-0.336 (-0.753, 0.081)	-0.132 (-0.509, 0.246)
20-29	9	0	0	0
Race (100)				
Hispanic	15	0.022 (-0.221, 0.265)	0.003 (-0.308, 0.314)	0.183 (-0.097, 0.462)
Other	7	0.040 (-0.300, 0.380)	-0.204 (-0.640, 0.231)	0.159 (-0.233, 0.551)
White	78	0	0	0
Job title (101)				
Captain or Chief	36	0.115 (-0.075, 0.305)	0.093 (-0.153, 0.339)	0.270* (0.054, 0.487)
Engineer	20	-0.107 (-0.336, 0.121)	0.031 (-0.264, 0.327)	0.165 (-0.096, 0.425)
Firefighter	45	0	0	0
Years as firefighter (100)				
>30	10	0.207 (-0.112, 0.526)	0.096 (-0.316, 0.508)	0.494** (0.137, 0.851)
21 - 30	39	0.103 (-0.113, 0.318)	-0.014 (-0.293, 0.264)	0.269* (0.027, 0.510)
11 - 20	24	0.152 (-0.090, 0.394)	0.011 (-0.301, 0.323)	0.231 (-0.040, 0.501)
<11	27	0	0	0
Body fat percentage (101)				
>24	33	0.085 (-0.123, 0.293)	-0.080 (-0.344, 0.184)	-0.057 (-0.295, 0.180)
>17.5 - 24	32	0.024 (-0.186, 0.233)	0.075 (-0.191, 0.341)	0.139 (-0.100, 0.378)
≤17.5	36	0	0	0
Body mass index (101)				
≥30	26	-0.110 (-0.373, 0.152)	-0.276 (-0.610, 0.057)	-0.072 (-0.376, 0.231)
25 - 29	57	0.035 (-0.196, 0.267)	-0.118 (-0.412, 0.176)	0.075 (-0.193, 0.343)
<25	18	0	0	0
House fire responses in last year (100)				
≥1/month	32	0.293 (-0.333, 0.919)	0.108 (-0.699, 0.914)	-0.578 (-1.287, 0.131)
<1/month	66	0.163 (-0.453, 0.780)	0.066 (-0.728, 0.860)	-0.728* (-1.426, -0.030)
none	2	0	0	0
Brush fire responses in last year (98)				
≥1/month	11	0.285 (-0.062, 0.631)	0.001 (-0.449, 0.450)	0.268 (-0.133, 0.669)
<1/month	73	0.226 (-0.025, 0.477)	0.093 (-0.233, 0.419)	0.106 (-0.184, 0.397)
none	14	0	0	0
Vehicle fire responses in last year (100)				
≥1/month	34	0.108 (-0.252, 0.468)	0.065 (-0.387, 0.516)	0.095 (-0.319, 0.510)
<1/month	59	0.115 (-0.232, 0.461)	0.258 (-0.177, 0.693)	0.140 (-0.259, 0.539)
none	7	0	0	0
Commercial fire responses in last year (98)				
≥1/month	10	0.291 (-0.021, 0.603)	0.080 (-0.327, 0.487)	0.086 (-0.282, 0.455)
<1/month	58	0.129 (-0.063, 0.321)	-0.006 (-0.256, 0.245)	-0.042 (-0.269, 0.184)
none	30	0	0	0

Abbreviations: ln, lognormal; CI, confidence interval; SCBA, self-contained breathing apparatus; PPE, personal protective equipment. * $p < 0.05$, ** $p < 0.01$

Table S1-2 (cont.). Unadjusted β coefficients (95% CI) indicating change in firefighter (ln) PFNA, PFOA and PFOS concentrations.

Independent Variable (n)	n	PFNA β (95% CI)	PFOA β (95% CI)	PFOS β (95% CI)
Industrial fire responses in last year (100)				
≥1/month	8	0.287 (-0.037, 0.611)	-0.051 (-0.472, 0.37)	0.141 (-0.238, 0.520)
<1/month	41	-0.006 (-0.185, 0.173)	-0.059 (-0.291, 0.173)	0.098 (-0.111, 0.307)
none	51	0	0	0
Hazardous materials responses in last year (101)				
≥1/month	13	0.302* (0.030, 0.574)	0.138 (-0.220, 0.496)	0.185 (-0.139, 0.508)
<1/month	54	0.222* (0.040, 0.405)	0.085 (-0.155, 0.326)	0.049 (-0.168, 0.266)
none	34	0	0	0
Firefighting foam used in last year (100)				
Type A only	64	0.082 (-0.183, 0.346)	0.201 (-0.131, 0.534)	0.153 (-0.150, 0.457)
Type B only	3	0.201 (-0.356, 0.758)	0.478 (-0.222, 1.179)	0.272 (-0.368, 0.912)
Both A and B	20	0.076 (-0.234, 0.386)	0.021 (-0.369, 0.41)	0.241 (-0.115, 0.597)
Neither	13	0	0	0
SCBA use with firefighting foam (87)				
No SCBA	67	0.088 (-0.136, 0.312)	0.073 (-0.220, 0.366)	-0.020 (-0.274, 0.234)
Uses SCBA	20	0	0	0
Wears SCBA during exterior fire suppression duties (97)				
Never	6	0.119 (-0.274, 0.513)	-0.088 (-0.602, 0.426)	0.001 (-0.460, 0.463)
Sometimes	68	0.005 (-0.202, 0.212)	0.081 (-0.190, 0.351)	-0.103 (-0.346, 0.140)
Always	23	0	0	0
Wears SCBA during ventilation activities (96)				
Sometimes	30	-0.040 (-0.229, 0.150)	-0.154 (-0.390, 0.090)	-0.011 (-0.234, 0.212)
Always	66	0	0	0
Wears SCBA during overhaul (97)				
Sometimes	72	0.008 (-0.190, 0.207)	-0.033 (-0.293, 0.226)	0.001 (-0.233, 0.234)
Always	25	0	0	0
SCBA early removal during overhaul (97)				
Might remove	35	-0.049 (-0.230, 0.132)	-0.156 (-0.391, 0.078)	-0.119 (-0.330, 0.093)
Never removes	62	0	0	0
PPE professionally decontaminated (100)				
≥12 months ago	54	0.14 (-0.031, 0.311)	0.244* (0.0280, 0.459)	0.082 (-0.118, 0.281)
<12 months ago	46	0	0	0
Handwashing frequency per 12-hour shift (100)				
<8	31	-0.11 (-0.380, 0.159)	-0.006 (-0.354, 0.341)	-0.067 (-0.377, 0.243)
9 - 11	33	-0.016 (-0.283, 0.250)	-0.074 (-0.418, 0.27)	0.152 (-0.155, 0.459)
12 - 19	21	0.12 (-0.170, 0.410)	0.126 (-0.248, 0.499)	0.183 (-0.150, 0.516)
≥20	15	0	0	0
Fire station construction year (100)				
before 1980	56	0.020 (-0.219, 0.269)	0.078 (-0.231, 0.386)	-0.044 (-0.326, 0.238)
1980 - 1999	28	-0.085 (-0.355, 0.185)	-0.016 (-0.357, 0.326)	-0.110 (-0.422, 0.201)
2000 or later	16	0	0	0

Abbreviations: ln, lognormal; CI, confidence interval; SCBA, self-contained breathing apparatus; PPE, personal protective equipment. * $p < 0.05$, ** $p < 0.01$

Table S1-3 Unadjusted β coefficients (95% CI) indicating change in firefighter (ln) PFOSA, PFUdA and Me-PFOSA concentrations.

Independent Variable (n)	n	PFOSA β (95% CI)	PFUdA β (95% CI)	Me-PFOSA β (95% CI)
Age (101)				
≥50	27	0.613* (0.008, 1.217)	-0.316 (-0.793, 0.160)	0.311 (-0.306, 0.928)
40-49	36	0.429 (-0.156, 1.014)	-0.272 (-0.734, 0.189)	0.149 (-0.449, 0.746)
30-39	29	0.055 (-0.544, 0.654)	-0.322 (-0.795, 0.150)	-0.059 (-0.670, 0.553)
20-29	9	0	0	0
Race (100)				
Hispanic	15	0.028 (-0.422, 0.478)	-0.149 (-0.487, 0.189)	0.250 (-0.197, 0.698)
Other	7	-0.698* (-1.327, -0.068)	0.614* (0.141, 1.087)	-0.559 (-1.186, 0.067)
White	78	0	0	0
Job title (101)				
Captain or Chief	36	0.340 (-0.019, 0.699)	0.049 (-0.226, 0.325)	0.278 (-0.079, 0.636)
Engineer	20	0.138 (-0.293, 0.570)	-0.194 (-0.525, 0.137)	0.188 (-0.242, 0.618)
Firefighter	45	0	0	0
Years as firefighter (100)				
>30	10	0.538 (-0.054, 1.130)	-0.174 (-0.635, 0.287)	0.422 (-0.166, 1.01)
21 - 30	39	0.368 (-0.033, 0.768)	-0.133 (-0.445, 0.178)	0.271 (-0.126, 0.669)
11 - 20	24	0.040 (-0.409, 0.488)	-0.240 (-0.589, 0.110)	-0.103 (-0.549, 0.343)
<11	27	0	0	0
Body fat percentage (101)				
>24	33	0.040 (-0.354, 0.433)	-0.454** (-0.739, -0.169)	0.003 (-0.388, 0.393)
>17.5 - 24	32	0.063 (-0.334, 0.459)	-0.294* (-0.582, -0.006)	-0.004 (-0.398, 0.389)
≤17.5	36	0	0	0
Body mass index (101)				
≥30	26	-0.122 (-0.623, 0.378)	-0.634** (-0.994, -0.274)	0.021 (-0.472, 0.513)
25 - 29	57	-0.075 (-0.516, 0.367)	-0.353* (-0.671, -0.036)	0.224 (-0.211, 0.658)
<25	18	0	0	0
House fire responses in last year (100)				
≥1/month	32	-0.983 (-2.158, 0.191)	0.134 (-0.775, 1.044)	-0.473 (-1.629, 0.684)
<1/month	66	-1.067 (-2.224, 0.089)	0.094 (-0.802, 0.990)	-0.775 (-1.914, 0.364)
none	2	0	0	0
Brush fire responses in last year (98)				
≥1/month	11	-0.117 (-0.780, 0.545)	0.170 (-0.332, 0.672)	0.317 (-0.334, 0.968)
<1/month	73	0.156 (-0.323, 0.636)	0.276 (-0.088, 0.64)	0.282 (-0.189, 0.754)
none	14	0	0	0
Vehicle fire responses in last year (100)				
≥1/month	34	-0.433 (-1.106, 0.240)	-0.051 (-0.568, 0.466)	0.136 (-0.537, 0.810)
<1/month	59	-0.246 (-0.895, 0.402)	-0.119 (-0.617, 0.379)	0.134 (-0.515, 0.782)
none	7	0	0	0
Commercial fire responses in last year (98)				
≥1/month	10	-0.110 (-0.704, 0.484)	0.249 (-0.206, 0.704)	0.155 (-0.422, 0.732)
<1/month	58	0.285 (-0.081, 0.65)	-0.004 (-0.284, 0.277)	0.373* (0.018, 0.729)
none	30	0	0	0

Abbreviations: ln, lognormal; CI, confidence interval; SCBA, self-contained breathing apparatus; PPE, personal protective equipment. * $p < 0.05$, ** $p < 0.01$

Table S1-3 (cont.). Unadjusted β coefficients (95% CI) indicating change in firefighter (ln) PFOSA, PFUdA and Me-PFOSA concentrations.

Independent Variable (n)	n	PFOSA β (95% CI)	PFUdA β (95% CI)	Me-PFOSA β (95% CI)
Industrial fire responses in last year (100)				
≥1/month	8	0.054 (-0.556, 0.665)	0.218 (-0.249, 0.685)	0.148 (-0.460, 0.756)
<1/month	41	0.346* (0.009, 0.683)	-0.178 (-0.435, 0.080)	0.308 (-0.027, 0.643)
none	51	0	0	0
Hazardous materials responses in last year (101)				
≥1/month	13	0.305 (-0.221, 0.830)	0.169 (-0.234, 0.572)	0.682** (0.173, 1.192)
<1/month	54	0.269 (-0.084, 0.622)	0.145 (-0.126, 0.416)	0.289 (-0.053, 0.631)
none	34	0	0	0
Firefighting foam used in last year (100)				
Type A only	64	0.122 (-0.371, 0.614)	0.091 (-0.291, 0.472)	-0.157 (-0.651, 0.338)
Type B only	3	-0.271 (-1.307, 0.765)	0.160 (-0.643, 0.962)	-0.374 (-1.410, 0.668)
Both A and B	20	-0.250 (-0.827, 0.326)	-0.012 (-0.459, 0.434)	-0.115 (-0.694, 0.465)
Neither	13	0	0	0
SCBA use with firefighting foam (87)				
No SCBA	67	0.306 (-0.119, 0.731)	0.089 (-0.221, 0.400)	0.140 (-0.273, 0.553)
Uses SCBA	20	0	0	0
Wears SCBA during exterior fire suppression duties (97)				
Never	6	0.102 (-0.629, 0.834)	0.421 (-0.141, 0.982)	0.173 (-0.553, 0.898)
Sometimes	68	-0.122 (-0.507, 0.263)	-0.117 (-0.412, 0.179)	0.024 (-0.358, 0.406)
Always	23	0	0	0
Wears SCBA during ventilation activities (96)				
Sometimes	30	-0.168 (-0.519, 0.183)	-0.100 (-0.375, 0.175)	0.094 (-0.252, 0.441)
Always	66	0	0	0
Wears SCBA during overhaul (97)				
Sometimes	72	0.162 (-0.206, 0.531)	0.013 (-0.276, 0.303)	0.192 (-0.171, 0.556)
Always	25	0	0	0
SCBA early removal during overhaul (97)				
Might remove	35	-0.029 (-0.366, 0.308)	0.054 (-0.209, 0.318)	-0.024 (-0.357, 0.309)
Never removes	62	0	0	0
PPE professionally decontaminated (100)				
≥12 months ago	54	0.053 (-0.274, 0.38)	0.063 (-0.186, 0.312)	0.044 (-0.28, 0.368)
<12 months ago	46	0	0	0
Handwashing frequency per 12-hour shift (100)				
<8	31	0.074 (-0.443, 0.590)	0.067 (-0.322, 0.456)	-0.081 (-0.590, 0.427)
9 - 11	33	0.152 (-0.359, 0.663)	0.245 (-0.140, 0.630)	0.061 (-0.443, 0.564)
12 - 19	21	0.206 (-0.349, 0.761)	0.290 (-0.128, 0.708)	0.22 (-0.327, 0.766)
≥20	15	0	0	0
Fire station construction year (100)				
before 1980	56	-0.206 (-0.663, 0.252)	-0.18 (-0.523, 0.163)	0.108 (-0.349, 0.565)
1980 - 1999	28	-0.084 (-0.59, 0.422)	-0.461* (-0.841, -0.082)	0.197 (-0.308, 0.702)
2000 or later	16	0	0	0

Abbreviations: ln, lognormal; CI, confidence interval; SCBA, self-contained breathing apparatus; PPE, personal protective equipment. * $p < 0.05$, ** $p < 0.01$

Table S1-4 Unadjusted β coefficients (95% CI) indicating change in firefighter (ln) blood metal concentrations.

Independent Variable (n)	n	Pb β (95% CI)	Hg β (95% CI)	Cd β (95% CI)	Mn β (95% CI)
Age (101)					
≥50	27	0.178 (-0.164, 0.520)	-0.249 (-0.914, 0.416)	0.392** (0.097, 0.687)	-0.027 (-0.215, 0.160)
40-49	36	-0.162 (-0.493, 0.169)	-0.377 (-1.021, 0.267)	0.045 (-0.241, 0.33)	0.002 (-0.179, 0.183)
30-39	29	-0.243 (-0.581, 0.096)	-0.217 (-0.876, 0.442)	0.062 (-0.230, 0.355)	0.047 (-0.139, 0.232)
20-29	9	0	0	0	0
Race (100)					
Hispanic	15	-0.161 (-0.425, 0.104)	0.209 (-0.276, 0.694)	0.08 (-0.152, 0.312)	0.118 (-0.017, 0.254)
Other	7	-0.242 (-0.612, 0.128)	0.441 (-0.238, 1.120)	0.127 (-0.198, 0.452)	0.083 (-0.107, 0.273)
White	78	0	0	0	0
Job title (101)					
Captain or Chief	36	0.065 (-0.144, 0.275)	-0.288 (-0.671, 0.094)	0.054 (-0.130, 0.238)	-0.105 (-0.212, 0.002)
Engineer	20	-0.114 (-0.366, 0.138)	-0.187 (-0.647, 0.273)	0.049 (-0.172, 0.270)	-0.026 (-0.154, 0.103)
Firefighter	45	0	0	0	0
Years as firefighter (100)					
>30	10	0.419* (0.084, 0.753)	-0.602 (-1.236, 0.032)	0.52** (0.249, 0.792)	-0.09 (-0.271, 0.091)
21 - 30	39	0.004 (-0.222, 0.230)	-0.14 (-0.569, 0.289)	-0.002 (-0.186, 0.181)	-0.004 (-0.127, 0.118)
11 - 20	24	-0.15 (-0.403, 0.104)	-0.191 (-0.671, 0.29)	-0.173 (-0.378, 0.033)	-0.007 (-0.144, 0.131)
<11	27	0	0	0	0
Body fat percentage (101)					
>24	33	0.043 (-0.185, 0.271)	-0.544** (-0.947, -0.141)	0.057 (-0.140, 0.254)	0.039 (-0.078, 0.155)
>17.5 - 24	32	-0.008 (-0.238, 0.222)	-0.25 (-0.656, 0.156)	-0.047 (-0.246, 0.152)	-0.04 (-0.158, 0.077)
≤17.5	36	0	0	0	0
Body mass index (101)					
≥30	26	0.015 (-0.272, 0.303)	-0.441 (-0.961, 0.079)	-0.024 (-0.276, 0.227)	0.104 (-0.043, 0.252)
25 - 29	57	0.146 (-0.107, 0.399)	-0.061 (-0.520, 0.397)	-0.083 (-0.305, 0.138)	0.09 (-0.041, 0.220)
<25	18	0	0	0	0
House fire responses in last year (100)					
≥1/month	32	0.129 (-0.559, 0.818)	-0.714 (-1.974, 0.546)	0.117 (-0.485, 0.719)	-0.089 (-0.435, 0.257)
<1/month	66	0.03 (-0.648, 0.709)	-0.621 (-1.862, 0.620)	0.068 (-0.525, 0.661)	-0.111 (-0.451, 0.23)
none	2	0	0	0	0
Brush fire responses in last year (98)					
≥1/month	11	0.127 (-0.244, 0.498)	0.551 (-0.144, 1.246)	0.309 (-0.021, 0.638)	0.204* (0.016, 0.393)
<1/month	73	0.141 (-0.128, 0.410)	0.474 (-0.029, 0.978)	0.103 (-0.135, 0.342)	0.108 (-0.029, 0.244)
none	14	0	0	0	0
Vehicle fire responses in last year (100)					
≥1/month	34	0.094 (-0.298, 0.487)	-0.009 (-0.724, 0.705)	-0.153 (-0.494, 0.188)	-0.084 (-0.280, 0.111)
<1/month	59	-0.011 (-0.389, 0.366)	0.254 (-0.434, 0.942)	-0.203 (-0.531, 0.125)	-0.117 (-0.306, 0.071)
none	7	0	0	0	0
Commercial fire responses in last year (98)					
≥1/month	10	0.071 (-0.272, 0.415)	0.128 (-0.509, 0.766)	0.101 (-0.198, 0.401)	0.070 (-0.103, 0.242)
<1/month	58	-0.011 (-0.223, 0.200)	-0.129 (-0.521, 0.264)	-0.016 (-0.200, 0.169)	0.096 (-0.010, 0.202)
none	30	0	0	0	0

Abbreviations: ln, lognormal; CI, confidence interval; SCBA, self-contained breathing apparatus; PPE, personal protective equipment. * $p < 0.05$, ** $p < 0.01$

Table S1-4 (cont.). Unadjusted β coefficients (95% CI) indicating change in firefighter (ln) blood metal concentrations.

Independent Variable (n)	n	Pb β (95% CI)	Hg β (95% CI)	Cd β (95% CI)	Mn β (95% CI)
Industrial fire responses in last year (100)					
≥1/month	8	0.299 (-0.045, 0.643)	-0.161 (-0.792, 0.470)	0.204 (-0.104, 0.513)	0.066 (-0.118, 0.250)
<1/month	41	0.012 (-0.178, 0.202)	-0.543** (-0.891, -0.195)	0.118 (-0.052, 0.288)	0.069 (-0.033, 0.170)
none	51	0	0	0	0
Hazardous materials responses in last year (101)					
≥1/month	13	-0.008 (-0.314, 0.298)	-0.331 (-0.886, 0.225)	0.136 (-0.130, 0.402)	0.053 (-0.105, 0.211)
<1/month	54	0.125 (-0.080, 0.330)	-0.326 (-0.699, 0.047)	-0.05 (-0.228, 0.129)	-0.013 (-0.119, 0.094)
none	34	0	0	0	0
Firefighting foam used in last year (100)					
Type A only	64	-0.051 (-0.340, 0.238)	-0.025 (-0.551, 0.500)	0.008 (-0.240, 0.257)	0.087 (-0.060, 0.235)
Type B only	3	-0.008 (-0.618, 0.601)	0.035 (-1.071, 1.141)	0.296 (-0.227, 0.819)	-0.047 (-0.357, 0.263)
Both A & B	20	-0.114 (-0.453, 0.225)	-0.317 (-0.933, 0.298)	0.002 (-0.289, 0.293)	0.006 (-0.166, 0.179)
Neither	13	0	0	0	0
SCBA use with firefighting foam (87)					
No SCBA	67	-0.172 (-0.416, 0.072)	0.063 (-0.392, 0.519)	0.032 (-0.181, 0.246)	-0.066 (-0.194, 0.062)
Uses SCBA	20	0	0	0	0
Wears SCBA during exterior fire suppression duties (97)					
Never	6	-0.112 (-0.505, 0.281)	0.593 (-0.187, 1.372)	0.112 (-0.251, 0.475)	0.133 (-0.093, 0.360)
Sometimes	68	-0.191 (-0.397, 0.016)	-0.209 (-0.620, 0.201)	-0.065 (-0.256, 0.126)	0.012 (-0.107, 0.130)
Always	23	0	0	0	0
Wears SCBA during ventilation activities (96)					
Sometimes	30	-0.200* (-0.386, -0.015)	-0.084 (-0.466, 0.299)	0.076 (-0.099, 0.251)	0.074 (-0.033, 0.182)
Always	66	0	0	0	0
Wears SCBA during overhaul (97)					
Sometimes	72	-0.059 (-0.260, 0.142)	-0.221 (-0.622, 0.180)	-0.002 (-0.187, 0.182)	-0.012 (-0.127, 0.103)
Always	25	0	0	0	0
SCBA early removal during overhaul (97)					
Might	35	0.103 (-0.079, 0.286)	-0.036 (-0.404, 0.331)	0.071 (-0.097, 0.238)	0.113* (0.011, 0.215)
Never	62	0	0	0	0
PPE professionally decontaminated (100)					
≥12 months	54	0.170 (-0.016, 0.356)	-0.102 (-0.448, 0.244)	0.025 (-0.138, 0.189)	-0.107* (-0.202, -0.011)
<12 month	46	0	0	0	0
Handwashing frequency per 12-hour shift (100)					
<8	31	0.101 (-0.190, 0.391)	-0.240 (-0.781, 0.301)	0.199 (-0.055, 0.452)	-0.010 (-0.164, 0.145)
9 - 11	33	-0.176 (-0.464, 0.111)	0.109 (-0.427, 0.645)	0.116 (-0.135, 0.367)	0.014 (-0.139, 0.167)
12 - 19	21	-0.109 (-0.422, 0.203)	-0.049 (-0.631, 0.532)	0.012 (-0.261, 0.285)	0.019 (-0.148, 0.185)
≥20	15	0	0	0	0
Fire station construction year (100)					
before 1980	56	-0.151 (-0.419, 0.116)	-0.326 (-0.809, 0.158)	-0.118 (-0.349, 0.112)	-0.143* (-0.277, -0.009)
1980 - 1999	28	-0.171 (-0.466, 0.125)	-0.504 (-1.039, 0.030)	-0.124 (-0.379, 0.131)	-0.182* (-0.330, -0.034)
2000 later	16	0	0	0	0

Abbreviations: ln, lognormal; CI, confidence interval; SCBA, self-contained breathing apparatus; PPE, personal protective equipment. * $p < 0.05$, ** $p < 0.01$